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BEYOND THE POINT OF NO RETURN

Forty years ago, British theoretician Stephen Hawking, a physicist at Cambridge University, hypothesized that rather than being completely dark as their name implies, black holes should emit a faint glow of particles – known today as Hawking radiation. Physicists wanting to test this theory were, however, literally left in the dark: Black holes in space are notoriously inaccessible.

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WASH!

Students bring clean water to rural Ethiopia and promote ***WA***ter, ***S***anitation and ***H***ygiene education

By Amanda Jaffe-Katz

What do budding Technion engineers with a soul do in their spare time? One group, some 15 members of the Ethiopia team of the Engineers without Borders – Technion chapter, is busy building a prototype water tank for the school in remote Meskele Kristos, that has no drinking water for its children and staff.

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ENGINEERING THE SYSTEM

Technion's flagship Master of Engineering Program in Systems Engineering has graduated more than 1,000 students over the last 15 years

By Gail Lichtman

"In systems engineering, the whole is greater than the sum of its parts," states Prof. Aviv Rosen, head of Technion's groundbreaking Master of Engineering (ME) Program in Systems Engineering and head of its Gordon Center for Systems Engineering.

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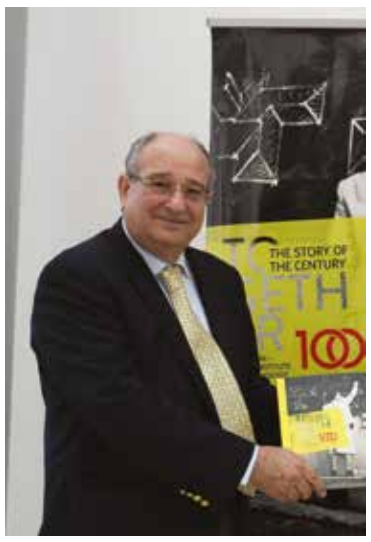
FROM THE PRESIDENT



Flashback 10 years ago, to December 10, 2004: the momentous occasion when we celebrated the receipt of Israel's first Nobel Prizes in science. At that time, I was VP for Resource Development and External Relations, and prior to that, dean of the Rappaport Faculty of Medicine. I well recall my sense of pride and gratification as I stood in Stockholm when two Technion colleagues from the Faculty of Medicine – Distinguished Profs. Avram Hershko and Aaron Ciechanover – brought such *nachas* to the entire nation.

In the decade since that pinnacle of scientific recognition, Technion has continued to go from strength to strength, gathering accolades for Israeli science and the "Start-up Nation." The secret of that success lies in our determination for scientific excellence, as well as our inclusiveness extended to all members of society and our global outreach that brings our expertise to developed and developing nations alike.
We strive to remain a sanctuary dedicated to tolerance and the preservation of knowledge for new, aspiring scientists and engineers, and for the talented corpus of researchers and academic faculty.

Publishing in the top journals, Technion faculty are elucidating more than one enigma puzzling the scientific community for years. From a breakthrough demonstration of the existence of the elusive Hawking radiation, to an unravelling of the mysteries of evolutionary developmental biology, young researchers hold aloft the universal beacon of learning that is Technion.

As always, Technion pioneers solutions to the country's most pressing needs. One top national priority is reversing the shortage of quality science and math (STEM) schoolteachers. We bring our own graduates back to campus to study for an additional BSc degree in high school STEM education. Such is Technion's commitment to the nation that we fund all their tuition.

Another necessity, identified primarily by the industry, is training systems engineers. To this end, we equip thousands of top-tier personnel with master of engineering degrees in this complex field at the Gordon Center for Systems Engineering. Both these programs – for retraining scientists and engineers as educators and for enhancing the skills of systems engineers in the field – are highlighted in this issue.

Technion researchers, students, and alumni alike are seeking new ways to enhance the quality of life of those with special needs. You can read about several exciting assistive technologies for deaf, blind, paralyzed, or speech-impaired populations in this issue.

Improving the lives of others through know-how observes no geopolitical bounds: the Technion chapter of Engineers without Borders continues to light the way with innovative and sustainable low-tech engineering solutions for less developed societies around the globe. Working with local communities from Ethiopia to Nepal, our student volunteers are fine-tuning their needs and providing the infrastructure that we take for granted: water, fire, and shelter. Their dedication is an inspiration to us all. I am sure you will enjoy this edition of *Focus*.

BEYOND THE POINT OF NO RETURN

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Prof. Jeff Steinhauer analyzes his findings from the acoustic black hole.

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By Amanda Jaffe-Katz

William Unruh, of the University of British Columbia, suggested that it might be possible to create a terrestrial analogy to the cosmic puzzle, and to investigate the laws of quantum physics via sound – in what he dubbed "dumb holes" – analogous to light in a gravitational black hole. Unruh argued that a sonic event horizon could be created by making part of a body of fluid flow faster than the speed at which sound travels in that fluid.

In 2009, experimental physicist Prof. Jeff Steinhauer at Technion's Faculty of Physics, indeed reported the world's first successful observation of a sonic black hole, by means of a very low temperature atomic Bose–Einstein condensate. Now, Steinhauer has detected Hawking radiation for the first time in the lab, with this dumb hole.

Steinhauer explains that his lab work involves an organized set of steps to create the conditions for and subsequently observe Hawking radiation. Each stage, when accomplished, has been published separately over the last five years.

First, he created an analogue black hole; next, he was able to measure a small quantity of phonons (units of sound energy); then, he applied the methodology to the black hole and looked for the distribution of phonons that occur naturally. Now, with his latest publication in *Nature Physics* in October 2014, Steinhauer says that, "In general, an experimental measurement of something heretofore predicted is very important for pushing physics forward. I showed that the Hawking mechanism really works."

> "I showed that the Hawking mechanism really works."

Such findings could one day help resolve the 'black hole information paradox' – a major enigma in astrophysics that questions whether information that falls into a black hole really disappears forever.

Significantly, the lab-created mechanism is an analogue of a charged black hole, which manifests two event horizons – an inner and an outer one. The horizons create paired particles of sound, or phonons. One phonon – having positive energy – escapes the horizon, while the negative energy partner remains trapped inside the black hole. While a single phonon is too weak to observe, the phonons inside the black hole bounce back and forth between the inner and outer horizons, giving rise to self-amplifying Hawking radiation. "Because the amplitude has grown exponentially, this allows me to observe Hawking radiation, which is the output of the black-hole laser formed between the horizons," Steinhauer says.

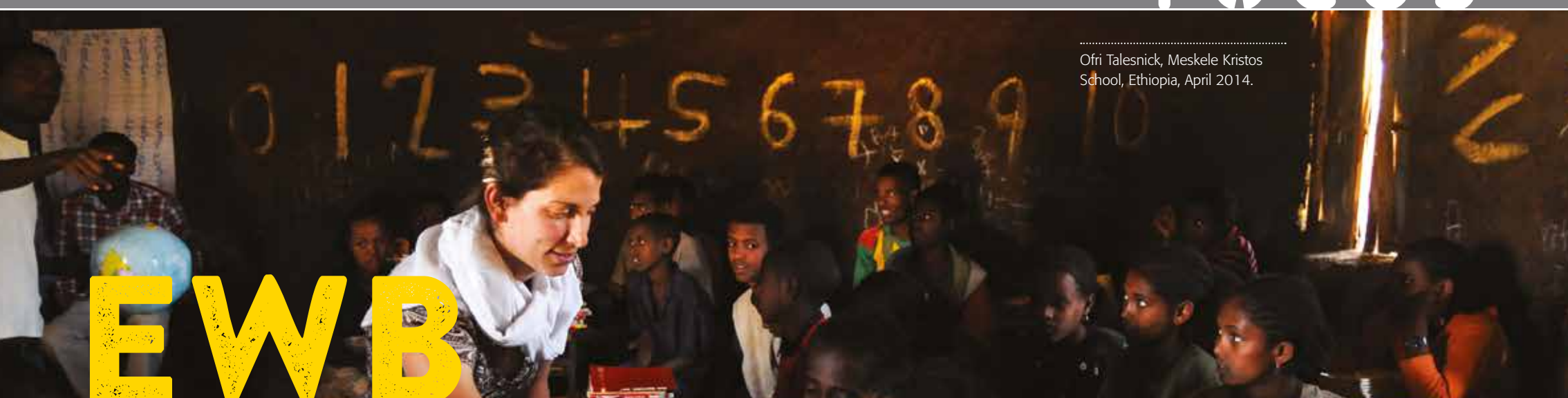
Steinhauer takes pictures of what happens at the dual event horizons and calculates the atoms' flow speed from these images. "Phonons move faster at very short wavelengths," Steinhauer explains his findings, "but it is not yet clear whether light (photons) can also do this."

In the recently published article, Steinhauer concludes: "This work suggests a method for probing the inside of a black hole… The experimental techniques presented here

> "This work suggests a method for probing the inside of a black hole."

could be used for further analogue gravity experiments, such as simulating the expansion of the early universe."

Steinhauer is already discussing the next steps with international theoreticians with whom he collaborates. One would be to enhance the detectors to sense radiation from a single horizon, which could help determine whether the pairs of phonons are entangled – another predicted quantum feature of real black holes.



Ofri Talesnick, Meskele Kristos School, Ethiopia, April 2014.

Photo: Eitam Shafran

EWB WASH!

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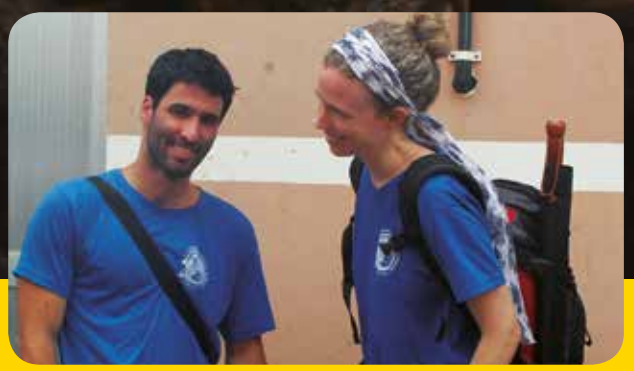


(l-r) Eitam Shafran and Yael Meyouhas, Engineering for Developing Communities summer program, China, 2014.

The first assessment trip was made in May 2013 by Yael Meyouhas and Nimrod Polonsky. "After visiting the village and returning with lots of information, we determined that our main objective was to supply water for the village school in order to reduce hygiene and other health problems. Currently, there is no running water in the school and no access to a nearby water source, which leaves more than 300 children without water, unless they carry a heavy water jerry-can all the way to the school," Polonsky explains.

"This not only means they don't have water to drink if they are thirsty," adds Orit Aviran, a science education student. "They can't wash their hands after defecating. They don't share our concept of basic hygiene."

"We constructed provisional apparatus for hand-washing and already started on a preparatory education program," says Meyouhas. "It will be most significant to continue this program when the water tank will be *in situ*."

Shay Moshenberg describes the team's solution: "We plan on installing a water tank for storing rainwater harvested during the two-month rainy season in order to have water in the dry season. We looked at the available – plastic – options out there but those solutions aren't so appropriate for village life: they don't provide the opportunity to produce more items and have more people benefit from the technique."

"The local people use earth as building materials, and we found out that some water tanks around the world were made out of compressed earth blocks (CEB)," Ofri Talesnick says.

CEB is a sustainable technology that the group is preparing to bring to Meskele Kristos. They borrowed the use of a machine in Israel's Negev desert to make the very dense

EWB-Ethiopia group members Shai Moshenberg, Matan Segman, Moti Ben-Shabat and Nachman Malkiel working on the prototype, Technion, December 2014.

blocks and are currently constructing and testing a prototype tank on campus.

Having the knowledge and a simple mechanical hand press as machinery in the village could allow families to make their own rainwater harvesting systems and also use the blocks for other construction projects.

Michal Kisra is on the prototype and water quality teams. "To get my hands dirty and build something from scratch is really exciting for me," she says. "How many engineers do you know who actually have the chance to do that?"

A second delegation of EWB students visited the village in May 2014, and a third visit is planned for early 2015. To raise money to fund the future trips, the group exhibited the stunning photographic images taken in 2014 by Eitam Shafran, team member, and is selling prints and postcards of the most popular pictures, as determined by the "wisdom of the crowds" who voted on their Facebook page.

Global Engineer

Yael Meyouhas has been active with EWB-Technion for the past four years, leading the Ethiopia group and taking part in the Negev group. She studied environmental engineering in the hope that this would give her the knowledge and skills to make an impact at the intersection between environment, community, and education. She is currently enrolled in the VIEWS program, to earn an additional bachelor's degree in STEM education.

Since 2012, Meyouhas serves as the manager of the Center for Global Engineering at Technion, headed by Prof. Mark Talesnick. In this capacity, she is responsible for the EWB – Technion chapter, and for the English-language Engineering for Developing Communities (EDC) summer program. This multidisciplinary four-week program provides undergraduate students with real-life fieldwork experience in small-scale sustainable community planning and development.

Nimrod Polonsky with villagers, Meskele Kristos, May 2013.

TOP HONORS FOR ENGINEERS

The U.S. National Academy of Engineering (NAE) bestowed foreign associate membership upon Profs. Alon Gany and Moshe Shoham at a formal ceremony in the U.S. capital. The total number of foreign associates is now 214. Election to the NAE is among the highest professional distinctions accorded to an engineer.

Gany, of the Faculty of Aerospace Engineering, was cited for "Advances in the development of solid propellants for rockets and scramjets." Gany heads the Fine Rocket Propulsion Center and Aerothermodynamics Laboratory. Shoham, incumbent of the Tamara and Harry Handelsman Academic Chair in the Faculty of Mechanical Engineering, was

Prof. Alon Gany

elected "For contributions to robotic technology for image-guided surgery." Shoham heads the D. Dan and Betty Kahn Medical Robotics Laboratory and is the founder of Mazor Surgical Technologies, the creator of the renowned Renaissance™ surgical guidance system.

Photo: Cable Risdon for NAE

(l-r) Charles O. Holliday, Jr., Chairman, National Academy of Engineering; Prof. Moshe Shoham; C. D. Mote, Jr., President, National Academy of Engineering.

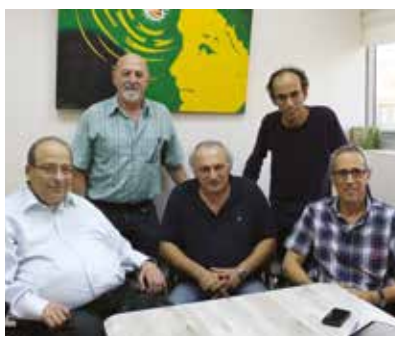
Get up and Go with UPnRIDE

"Get up, stand up, stand up for your right"
– Bob Marley

By Amanda Jaffe-Katz

From the makers of the revolutionary ReWalk exoskeleton, the innovative UPnRIDE wheelchair is moving forward upright accessibility for millions of wheelchair users worldwide.

Whereas ReWalk is a walking device, UPnRIDE is a mobility device that belongs to the category of smart wheelchairs. The UPnRIDE team demanded of their industrial designer one overriding feature: the user's disability must not be apparent when in the device. The result – a design that superficially resembles a recreational Segway® transportation device.



The UPnRIDE team, *(l-r)* Dr Amit Goffer, Nathan Lowi, Dudu Haimovich, Roee Haimovich, and Oren Tamari.

However, the new device will be much more stable and able to respond automatically to hazardous situations. Whatever the level of paralysis, UPnRIDE ensures that users will always be safely in the device, and their center of gravity remains the same.

"The health benefits of transitioning from sitting to standing are huge, as well as the increase in self-esteem," says Dr Amit Goffer, co-founder and quadriplegic. "In addition, the economic benefits for the medical insurance companies who will provide their clients with our product will soon outweigh the initial outlay. Less re-hospitalizations and fewer medical complications. After the second year of use, each patient will be making money for their insurance provider!"

Wheelchair users set to benefit from UPnRIDE include quadriplegics, those with spinal cord injuries, traumatic brain injury (TBI), CP, MS, and other conditions. And importantly, Goffer will be one of them. "In fact, we're making a wheelchair for me," says the inventor, who has helped so many paraplegics walk again with ReWalk that he himself is unable to use.

Currently manned by five engineers – all Technion graduates – the start-up company UPnRIDE Robotics Ltd is nearing the end of the initial investment stage and plans to have ready a prototype for feasibility testing in February 2015. This will be followed in October 2015 with a beta model, for clinical trials and for exhibitions.

Another of the three partners, CEO Oren Tamari, says, "We have raised more money through OurCrowd and angel investors than we had anticipated and together with a government Chief Scientist's R&D grant, our company will have enough funding to see us through to production in around three years' time."

The state-of-the-art wheelchair allows full mobility in both sitting and standing positions, on any urban surface. Unlike available upright wheelchairs, UPnRIDE will provide both indoor and outdoor mobility. "Our product's superior stability will enable it to negotiate slopes, and uneven surfaces," Tamari adds.

"We are quite confident about the technology, that is patent pending," Tamari continues, "and it involves much less complexity than ReWalk,

"Today, people know that should they become paralyzed, the wheelchair is their destiny… We are developing a game changer."

which is already a success. As with any innovative product, the market is our biggest challenge."

That said, UPnRIDE Robotics Ltd figure that their potential market, in the developed world alone, could reach the more than eight million wheelchair users.

"Today, people know that should they become paralyzed, the wheelchair is their destiny. It is the gold standard. But, we are developing a game changer," Tamari explains.

Other members of the interdisciplinary team are co-founder Dudu Haimovich, his physicist son, Roee Haimovich, and Nathan Lowi. The five all qualified at Technion, from the Faculties of Physics, Electrical Engineering, Mechanical Engineering, and the National College for Practical Engineers.

As with conventional powered wheelchairs, the UPnRIDE will recharge overnight from any standard wall outlet (electricity socket).

The end-user price will be affordable, and no more than high-end power wheelchairs.

Dr Amit Goffer will receive an Honorary Fellowship from Technion at the 2015 Board of Governors meeting in June.

"The health benefits of transitioning from sitting to standing are huge, as well as the increase in self-esteem."

20/20 Blind Sight

Electrical Engineering student Gal Dalal demonstrates indoor navigation app for the blind

Undergraduate students from Technion's Faculty of Electrical Engineering developed a navigation application for blind people, based on a Kinect camera, Android mobile phone device, and headphones. In the Seeing by Hearing portable device, images are obtained from the surrounding area, and sound warnings regarding obstacles are given along with instructions to bypass them.

Tzahi Simkin, Gal Dalal, and Danny Zilber worked on the project under the supervision of Koby Kohai, chief engineer of the Control Robotics and Machine Learning Lab. "The technological advantage of the Kinect camera lies in its ability to take very good depth images," says Simkin. "This field is continually evolving, with cameras becoming smaller and less expensive all the time."

"The camera sits on a belt and takes depth images of the surrounding area," explains Dalal. "The wireless device processes this information and gives the user an auditory indication through the app, warning them of obstacles and directing them to designated objects that the application is previously programmed to recognize."

Simkin adds: "We haven't yet tested the product with blind people but we tested it ourselves when blindfolded, and it worked. There are over 150 million blind and visually impaired people in the world, yet the number of technological solutions offered to them today is very limited. Despite advances in technology, the best means of guidance remains a Seeing Eye Dog or cane."

"The project received full marks," comments Kohai.

Turning Actions into Words

Computer science students take up the gauntlet with innovative sign-to-speech device

By Amanda Jaffe-Katz

Technion student Riziq HabibAllah grew up in Ein Mahil, an Arab village near Nazareth with Israel's highest incidence of congenital deafness, due to consanguineous (within the family) marriage. "One day in my village I saw three people together: my grandfather, a classmate who was blind, and a cousin who was deaf. I thought to myself, 'There's no way these three can ever communicate with each other!' And I decided something needs to be done to fix that," he says.

Thus inspired to help his family and neighbors as well as the many other hearing-impaired individuals around the world, HabibAllah was able to explore this idea with four teammates when he took part in a 36-hour "Makeathon" held in Nazareth. Their innovation was a smart universal glove (SUG) that can convert sign language into voice – using a smartphone for the output. This allows complete two-way communication between hearing-impaired and hearing people, who do not understand sign language.

(l-r) Technion Computer Science students Bahaa Khalilieh and Riziq HabibAllah

"A deaf-and-dumb person can only sign their own name by spelling it out, letter by letter. Our device will translate the individually signed characters into their spoken name."

The winning SUG mock-up sign-to-speech device

While Ein Mahil translates as "spring of the barren land," HabibAllah's team – four of them current Technion Computer Science (CS) students or alumni – is anything but fruitless. They reaped First Prize: Tickets to the prestigious Mobile World Congress 2015 in Barcelona, with air travel and hotel package included.

The Makeathon event was hosted by Tsofen, an Arab-Jewish organization promoting the integration of Israel's Arab Citizens into the high-tech industry. Entries were judged on several criteria, including originality, need for the new technology, presentation, and whether or not the invention actually worked.

While there are other sign-to-text developments on the market that use cameras and smart gloves, the SUG comprises a smart glove with multiple sensors, software that connects it to a smartphone app via bluetooth, and, importantly, it displays a unique level of accuracy. Its most innovative feature is that the signer can express any word, using both standardized signs and individual letter signs.

Teammate and fellow CS student, Bahaa Khalilieh, gives a poignant example: "A deaf-and-dumb person can only sign their own name by spelling it out, letter by letter. Our device will translate the individually signed characters into their spoken name."

Another original development in the pipeline is for individual users to input predefined shortcuts into the system. Thus, a whole word, or phrase, can be simplified to a single, user-specific sign.

Khalilieh explains that the glove can also have other applications, not just for sign language. For example, worn on the functioning hand it can act as a control device to be used in conjunction with a physiotherapy device worn on a paralyzed limb.

The team, having shown proof-of-concept with their mock-up at the Makeathon, are now working on a prototype that will enable them to raise money from potential investors to develop a viable product and bring it to market.

"Technion teaches you how to think," says Khalilieh, who holds a student job at Intel. "It is the ability to think in the abstract that eliminates all limitations to what you can achieve."

HabibAllah's high school principal recommended him as an exceptionally gifted pupil and he joined Technion's NAM (Excellent Arab Youth) program. He started at the Faculty of Electrical Engineering but preferred to switch to CS where he is now completing his BSc.

"If you survive four grueling years at Technion, you will never give up," adds HabibAllah. "And I am determined to make a difference in the world."

"If you survive four grueling years at Technion, you will never give up. And I am determined to make a difference in the world."

Other team members are Ahmad Soboh, who graduated CS in 2014 and is now a Software Engineer at Mellanox Technologies; Morad Morad, 2013 CS graduate now a Development Engineer at Cadence Design Systems; and Ebraheem Saleh, who studied at Jerusalem College of Engineering.

Free Speech

Alumni start-up Voiceitt, co-founded by CEO Danny Weissberg and CTO Stas Tiomkin, is developing a voice recognition app – Talkitt – that enables people who have motor, speech, and language disorders to communicate easily, using their own voice. The software-based solution can run on any mobile or wearable device. Talkitt generates intelligible output from any language for people whose own speech production is impossible to comprehend, by recognizing their vocal patterns and translating unintelligible pronunciation into understandable speech.

Serial entrepreneur Dr Yoav Medan, himself a Technion alumnus and Visiting Scientist at the Faculty of Electrical Engineering, serves as Voiceitt's Technological Adviser. "Voiceitt has come with a really unique solution for enabling people with speech impairment to bridge the gap between them and normal hearing people who could not understand them," Medan says.

Voiceitt was selected audience favorite at the Wall Street Journal Digital startup showcase in October 2014, and in December 2014, Philips North America announced VoiceItt as the grand prize winner of the second annual Philips Innovation Fellows competition.

This novel technology will not only benefit people with speech disabilities, but also their family members, friends, and caregivers who communicate with them on a daily basis.

ENGINEERING THE SYSTEM

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(l-r) Dr Avigdor Zonnenshain, senior member of the Gordon Center; Inna Tarshish, Class of 2010; Prof. Aviv Rosen, head of the Gordon Center; Dr Zvi Meiri, who has taught in the Master's program from Day 1; Prof. Peretz Lavie, Technion president; and Michal Iluz, Class of 2009, now doing a PhD in Systems Engineering at the Davidson Faculty of Industrial Engineering and Management, with the support of the Gordon Center.

Systems engineering (SE) is s new field of engineering. It is found in every aspect of technological industries – from large power plants to small personal computers – and teaches focusing on the "big picture."

"Technion's ME Program is a large-scale program – including multi- and interdisciplinary fields of engineering as well as sociology, economics, health, risk assessment, and so on," explains Rosen. "It concerns everything that has to be taken into consideration when designing very complex, multidisciplinary systems. After all, a project can be technologically excellent but fail because of its 'soft' aspects, such as cost, life expectancy, or time frame. SE teaches how to combine knowledge and capability in order to arrive at the optimum product."

"Systems engineering teaches how to combine knowledge and capability in order to arrive at the optimum product."

Rosen, who served as dean of the Faculty of Aerospace Engineering from 1995 to 1998, was approached by leaders in the aerospace/defense industries with requests for the Technion to start a master's program in SE. Such industries deal with large, multisystem projects.

In a rare move for academia, the committee formed to set up the SE program was made up mostly of members from industry and the curriculum was designed with industry requirements in mind. Many of the teachers are those with doctorates who went to industry and are able to draw on their own experiences in dealing with complex projects.

In 1999, the ME Program in Systems Engineering began under the auspices of Technion's Azrieli Division of Continued Education and Extension Studies. The 2.5-year-long, non-thesis program is open to those with a bachelor's of engineering or science from a recognized academic institution, who also have at least three years of professional experience. Students take more courses than a thesis-based degree, and complete a group project.

Some 1,000 systems engineers have graduated Technion's SE program.

Photo: IAI

Complex systems – from defense apparatus like the Arrow anti-ballistic missile defense system to integrated medical diagnostics – benefit from the expertise of Technion-trained systems engineers.

The program is designed for students interested in expanding their existing professional abilities. It teaches how to lead complex projects with many components that incorporate a wide range of specifications. Students learn to use interdisciplinary skills and tools. Some of the practical skills imparted include: analyzing systems, reviewing complex processes and innovative operational methods, assessing technological reliability, planning and engaging in strategic decision making where uncertainty is involved, understanding product lifetime testing, analyzing and defining requirements of software intensive systems, knowledge of administrative aspects and understanding of economic models.

Students study once a week for six hours in the afternoons/evenings. Last year there were three classes – one class meeting in Haifa on the Technion campus and the other two at Technion's Sarona campus in Tel Aviv. In the 15 years since the SE program started, some 1,000 students have graduated, making this the largest ME degree at Technion.

Graduates include personnel from the Israel Defense Forces and many civil and defense-related industries. "Today, our graduates are spread throughout Israeli industry," Rosen says.

"This is not an easy program," Rosen notes. "It is intensive and very demanding. Nevertheless, it is very popular and over 90 percent of those who start, complete it. Why? Because it gives students practical, concrete skills. I am always surprised at the number of students who after only a few weeks come up and say they are already applying what they learned at work. In addition, a lot of the work is done in groups of two or three because teamwork is how it is done in industry. And the program also teaches things that students may not need today, but may be of importance to them in the future."

Avner Shadmi, who today is the Head of the Traditional Industries Section in the Ministry of Economy Chief Scientist Office, was a project manager of a large, multidisciplinary aerospace project when he decided to enroll in the ME program. "I realized that I was performing my job based on experience, intuition and common sense, without any formal training," he relates. "I felt that there was a huge gap and obtaining practical, proven tools would fill this gap."

"I was not disappointed from the program," he goes on. "First of all, I gained theoretical and practical tools in a wide range of topics. This knowledge helped me in the positions I went on to hold. Furthermore, the program provided me with the confidence to make a complete career change. I became a freelance consultant, successfully providing SE support to several major companies. I would not have dared do this without the solid foundation laid by the ME program. And now I am in my current job. What more could one ask for?"

Unlike most SE students, Inna Tarshish came to the program from a background in science – not engineering.

"When I came to SE, the staff and other students looked at me strangely because I was from R&D in the semiconductor industry," Tarshish explains. "They didn't realize that this industry also requires SE. I was looking at projects from the perspective of the scientist. I had theoretical tools but not enough engineering tools. I needed analytic and investigative tools as well as to learn how to optimize and build a project."

Today, an advanced application development engineer at KLA-Tencor, Tarshish says that the program changed her career path. "SE gave me the tools to manage projects, allot resources, develop new systems and move from the niche of individual contributions to integrating a number of fields. I also learned about the human factor in projects and how to provide customer support in providing optimized solutions."

"The students are mature people from different backgrounds with different experiences. The synergy is very interesting."

Her group's final project was for locating survivors at sea. This topic generated interest among different agencies both in Israel and abroad.

"The beauty of the SE program lies in its variety of participants," Tarshish states. "The students are mature people from different backgrounds with different experiences. The synergy is very interesting."

Rosen notes that the SE program's impact on Israeli engineering and its economy has been great. "The program is having an immediate, as well as a long-term effect. People from industry tell me that rarely are there design reviews of their projects without an SE graduate present to evaluate. This is a huge change," he concludes.

RE: Views

TECHNION'S FLAGSHIP VIEWS PROGRAM TRAINS CALIBER HIGH SCHOOL STEM TEACHERS AS A TOP NATIONAL PRIORITY

Sharon Tamir, ex-naval officer, Views alumnus and inspiring physics teacher at Leo Baeck High School

Prof. Orit Hazzan, at the helm of the Views program

By Amanda Jaffe-Katz

Many Western countries, including Israel, are currently facing a shortage in high school STEM (Science, Technology, Engineering and Mathematics) teachers. As a remedy, Technion launched the Views program in 2011 that provides Technion graduates with an additional qualification in education.

"Technion did not wait for the crisis in STEM education to happen before seeking a solution; nor did Technion wait for government funds to start the program. Rather, the Technion was proactive and launched Views from its own resources, as one of its efforts to stop the impending collapse in science education," notes Prof. Orit Hazzan, head of the Department of Education in Science and Technology that implements this innovative program.

"Views encourages the best STEM professionals in Israel – Technion alumni – to be teachers; these teachers will provide the next generation with top-tier STEM education and skills."

MABATIM, Views' Hebrew acronym, stands for engineers/scientists in science and technology education. "Views invites Technion graduates back to the Technion – tuition free – to study toward an additional bachelor's degree in our Department," Hazzan explains. "This extra BSc degree includes a high school STEM teaching certificate in one of eight tracks: math, physics, biology, chemistry, computer science, environmental sciences, electrical engineering, or mechanical engineering." Notwithstanding their full study scholarships, participants need not commit to teaching in the education system.

Similar to a part-time MBA course, students study one full day or two half-days a week across two years, and can continue working as scientists and engineers in the industry in parallel to their studies. "The skills gained through Views are also useful in the high-tech industry for coping with new knowledge and technological developments," Hazzan points out. "Indeed, their employers let them attend their studies without deducting from their salaries."

As of October 2014, 243 Technion graduates are enrolled in Views: 50 have already completed the two-year program. And some 50 percent are already teaching in schools today. "Views encourages the best STEM professionals in Israel – Technion alumni – to be teachers; these teachers will provide the next generation with top-tier STEM education and skills," Hazzan continues.

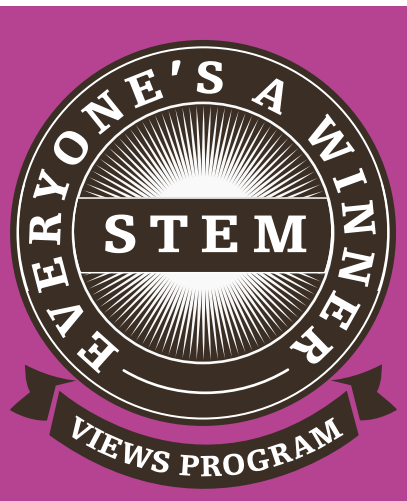
The Views program has trebled the number of students in the Department, with Views students joining the regular undergraduate students in their studies. One fifth of the students are enrolled in the technological tracks – electrical engineering and mechanical engineering education – which have tripled in size since Views was launched. This is important due to the recent effort to revive technological education in Israel.

According to the OECD's most recent report, Hazzan notes, Israel ranks among the five countries with the highest level of inequity, together with the United States, Turkey, Mexico, and Chile. Some Views graduates of the technological education tracks also teach in the vocational education system – whose graduates are in demand both by the IDF and by the industry. In this way, Technion contributes to reducing the family-income inequality in Israel.

Technion is now expanding Views to include current Technion students, not just alumni. "Technion's vision is that by 2020, some 1,000 Technion alumni will be qualified to teach STEM in Israeli high schools," Hazzan summarizes. "When we do the math, this implies that around 10 percent of STEM teachers in Israel will be Technion graduates. If every one of them teaches just one class of 25 pupils per annum, each year 25,000 pupils in Israel will be taught STEM by a Technion graduate."

"Technion's vision is that by 2020, some 1,000 Technion alumni will be qualified to teach STEM in Israeli high schools."

Many of these pupils will be inspired to study at Technion, where some will also undertake a Views training themselves. "We will have created a cycle that continues to cultivate future Technion students, and, as a spillover effect, fosters Israel's economy," Hazzan concludes.



Everyone a Winner

Technion graduates gain potential mobility within the industry or in education, if they choose it or when economic crisis or age-related redundancies apply.

High-tech industry gains personnel with essential pedagogical knowledge.

Technion gains better-educated future Technion students.

Department of Education in Science and Technology benefits in particular since Views students bring relevant and up-to-date knowledge to regular students.

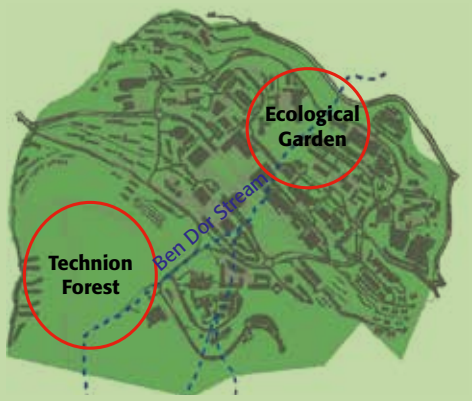
High school educational system and STEM curriculum development benefit since Views graduates introduce innovations from industry into the school system.

Government wins since Views may alleviate the need to invest special effort and funds to attract qualified people to education.

Israel wins a new pool of scientists and engineers with educational backgrounds.

GREEN ALL OVER

Fulfilling an ecological vision for the campus

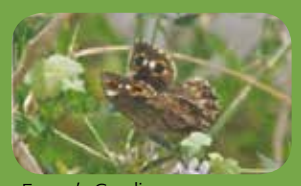


The Technion forest provides habitat for wildlife within the campus and contains mammal species not found elsewhere in the campus, including the golden jackal, wild boar, rock hyrax and protected species including the chukar partridge and the endangered plant, the common myrtle.
Illustration: Dr David Troupin


Wild Boar


Golden Jackal


Greater Horseshoe Bat


Freyer's Grayling


Chukar Partridge

An educational experience for the public at Technion's Ecological Garden.

By Daniel Orenstein

Unbeknownst to most of the campus community of students, faculty, staff and guests, the actual biological community of the Technion campus is far greater than the thousands of humans that walk in and out of its gates every day. Members of this expanded community make their homes on or between the campus buildings, in the landscaped strips between the buildings, or in a great expanse of planted and natural forest on the southern slopes of the campus. These individuals fly and flutter, crawl and run, burrow or just stand in one place – they are the previously undocumented biodiversity of the Technion campus, and they are now full partners in planning and management of the campus.

In early 2014, the Technion established a professional planning team with three goals – a strategic master plan, a statutory land use plan, and a plan for immediately improving the identity and the day to day functioning of the campus. Prof. Shamay Assif, former chair of the Ministry of Interior's Planning Administration, Prof. Yael Moria-Klain and Architect Vera Tsubari were appointed heads of the team, which included a range of advisors, faculty members and student workers with diverse expertise: from education to sociology, architecture, and planning. With the goal of guiding the Technion towards global leadership in ecological and environmental sustainability, an ecological advisory team was established, including experts in the fields of ecology, transportation, energy use, water management, and green architecture.

Immediately we set to building a vision of an ecologically sustainable campus, or "eco-campus." We suggested that the Technion, as an eco-campus, must address the dominant environmental challenges of the day, including biodiversity loss, degradation of ecosystems and ecosystem processes, pollution, lack of ecological awareness, and anthropogenic climate change. Our first step in this direction, completed by graduate student David Troupin, was to survey North American campuses and how they internalize ecological principles into their planning. The near consensus among campuses was that 1) a maximum amount of open space should be preserved for nature and multiple non-land-consumptive uses; 2) campus construction should be compact; and 3) there should be green corridors connecting the various open spaces on campus.

Next, we initiated a campus biodiversity survey, directed by planning graduate student Ella Segal. At the beginning of September 2014, Segal brought to the campus the leading biodiversity surveyors in Israel – specializing in butterflies, mammals, plants, birds, and bats. With the results of the survey, which has already revealed a robust ecological community on campus, we will map out areas of high ecological importance, such that the planning committee can designate areas for nature and nature-related uses.

The third step involved my students in the faculty who were studying in the course "Ecological Issues on the Israeli Landscape." The students were tasked with developing implementable plans that are rooted in ecological principles, and serve the goals of biodiversity preservation and ecosystem restoration. The students developed innovative ideas from extending Technion's ecological garden (our existing center for ecological education and restoration) into the main campus, to restoring the Ben-Dor riverbed which currently runs in drainage pipes through the center of campus, to green roofs and butterfly gardens throughout the campus. Those ideas are currently under review by the planning committee.

With the impending integration of these ideas and principles into the Technion's master and statutory land use plans, the Technion will establish itself as a national leader of ecological innovation, on par with some of the most progressive university campuses worldwide. The implementation of ecological principles will benefit all of the Technion's biologically diverse community – from those with wings, to those that walk on four legs, to those that walk upright, study, teach, reside in or visit the campus.

Dr Daniel Orenstein is assistant professor in the Faculty of Architecture and Town Planning.

GOING FOR GOLD

Technion's team won a gold medal at the iGEM (International Genetically Engineered Machine) competition in October 2014 held at MIT (Massachusetts Institute of Technology). The team, based in the Faculty of Biotechnology and Food Engineering and mentored by Prof. Roee Amit, developed a biological system that uses bacteria to detect the presence of substances such as allergens, toxins, and heavy metals in food and water.